Searching for Spotted Stars

Project Facts

Active Dates
November 10-13

Astronomer

Douglas O'Neal

Telescope

2.7-meter Harlan J. Smith Telescope

Instrument

Coudé spectrometer

The Pleiades star cluster.

Contrary to popular belief, not all stars are smooth, featureless balls of gas. Many stars are blemished with starspots — similar to sunspots on our Sun. Like sunspots, starspots are regions of cooler temperatures that appear as dark blemishes. However, although astronomers can take pictures of the Sun's surface and measure its sunspots, almost all other stars are too far away to photograph as anything but pinpoints of light. So how do astronomers see starspots on a pinpoint?

One way is to observe a star as it rotates. If more starspots are on one side, that side will be dimmer. This technique of measuring light variation is useful to find out where most starspots are located, but it can not reveal specifics about the spots, like their size. To solve this problem, Douglas O'Neal from Allegheny College and his collaborators have found another technique for understanding starspot coverage.

Doug and his collaborators (Manfred Cuntz from the University of Texas at Arlington, James Neff from the College of Charleston, and Steven Saar from Harvard-Smithsonian Center for Astrophysics) are taking advantage of the magnetic characteristics of stars with spots. On certain stars with temperatures equal to or less than the temperature of the Sun, the amount of the molecule titanium oxide is not constant across the star's surface. At high temperatures, molecules separate into their component elements. So, if molecules exist, then they must be coming from cooler regions of the star's surface — regions like starspots. The detection of these titanium oxide molecules allows astronomers to identify the location and size of the spots.

Previous observations for this project were done on a smaller telescope that consequently had less light gathering ability. To accommodate the

telescope, the targets of the project were a random assortment of stars that were bright enough to observe. Although this initial data was important, when testing a group of random subjects, often there are too many variables to draw a conclusion. To eliminate any problems caused by an inconsistent observation sample, Doug and the team have chosen the young Pleiades cluster as the target for their current project. Stars within a cluster probably formed at the same time and out of the same material so conclusions about their characteristics will be easier to generalize. Also, young stars typically rotate faster than older stars and have more magnetic energy. Consequently, they have more starspots to study.

Doug says he and his collaborators hope that this project will answer many questions about how the rotation, orientation of the star (relative to astronomers' line of sight), and chemical make-up affect starspot coverage. In addition to gathering some fascinating data, during the project Doug will also have time to experience one of his favorite parts of this research — the "wonderful sky." Doug says a northeastern clear night "is not even as good as an average night at McDonald."

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